

REMARKS

Reconsideration and allowance of the present patent application based on the foregoing amendments and following remarks are respectfully requested.

By this Amendment, claims 40, 41, 84 and 117 are amended. Support for the amendments to the claims may be found, for example, in the embodiments described at page 49, lines 4-24 and page 86, lines 11-15 of the present patent application. No new matter has been added. Accordingly, after entry of this Amendment, claims 40-42, 48-49, 84, 86, 88, 92-98, 117 and 126 will be pending in the patent application. Since this Amendment is being presented together with a Request for Continued Examination, entry of this Amendment is respectfully requested.

Claims 40 and 126 were rejected under 35 U.S.C. §102(b) based on Smither (U.S. Pat. No. 5,004,319). The rejection is respectfully traversed.

Claim 40 recites an optical apparatus comprising an optical system that forms a two-dimensional image, the optical system comprising, *inter alia*, “a variable optical-property mirror, ... wherein the variable optical-property mirror has a reflecting surface that is deformable, and wherein the reflecting surface is a free-formed surface having only one plane of symmetry.”

It is respectfully submitted that there is nothing in the cited portions of Smither that remotely discloses, teaches or suggests each and every limitation recited in claim 40 including the features identified above.

By way of review, the cited portions of Smither disclose a method and apparatus for altering the focal length of a focusing element. *See* Smither at col. 2, lines 40-57. Alteration of the focal length is performed by creating a thermal gradient between the surfaces of the focus element. *Id.* Smither discloses in FIGS. 1, 5a-c and 9 various types of bent crystals having reflecting surfaces.

However, unlike claim 40, the cited portions of Smither do not disclose, teach or suggest that the reflecting surface of the optical elements of FIGS. 1, 5a-c and 9 are free-formed surfaces having only one plane of symmetry. For example, with respect to FIG. 1 of Smither, there is no teaching or suggestion that the reflecting surface of element 10 (shown in cross section in FIG. 1 and following the contour of arc 23) has only one plane of symmetry. With respect to FIGS. 5a-c and 9, the reflecting surface of elements 60-80 and 125 each include at least two planes of symmetry. Nowhere do the cited portions of Smither disclose,

teach or suggest a variable optical-property mirror that has a reflecting surface that is deformable, and wherein the reflecting surface is a free-formed surface having only one plane of symmetry, as recited in claim 40. Thus, for at least this reason, claim 40 is patentable over Smither.

Claim 126 is patentable over Smither at least because this claim recites an optical unit comprising, *inter alia*, a transparent optical element having an entrance surface and an exit surface that is different from the entrance surface; and a reflection-type variable optical-property element having a variable optical power, the reflection-type variable optical-property element being arranged integrally with the transparent optical element.

Smither is discussed above. The Examiner refers to FIGS. 1 and 9 of Smither as allegedly disclosing, teaching or suggesting the above identified features of claim 126. Specifically, the Examiner equates circle 24, source 15 and element 21 of Smither with, respectively, the transparent optical element, the entrance surface and the exit surface of claim 126. This is incorrect. Circle 24 of Smither does not correspond, in any way, to a transparent optical element. Nor do source 15 and element 21 of Smither correspond to an entrance surface and an exit surface of such circle 24.

Smither merely discloses that circle 24 is a focal circle, which is an imaginary circle. See Smither at col. 3, lines 62. However, a focal circle is not a structural element. Focal circle 24 of Smither does not have any structural attribute and there is nothing in the cited portions of Smither to support the Examiner's conclusion that circle 24 is a transparent optical element. The only structural element shown in FIG. 1 of Smither is the bent crystal 10. In support of this, Smither teaches that the focal circle 24 is depicted in FIG. 1 of Smither to show the positional relationship between point source 15 and line image 21 and that the radius 22 of the arc 23 for the bent crystal 10 is twice the radius of the focal circle 24. See Smither at col. 3, lines 56-59. In further support of this, Applicant respectfully submits that two physically existing members cannot occupy a same single position and, according to claim 126, the exit surface of the transparent optical element is different from the entrance surface. However, since the point source 15 (a physically existing member) for emitting the beam 14 and line image 21 of Smither both lie on the circumference of the same circle 24, they would be part of the same surface (*i.e.*, the surface defined by the circle) according to the Examiner's logic. Thus, point source 15 and line image 21 cannot correspond, in any way, to an entrance surface and a separate exit surface as in claim 126. In view of the above, focal circle 24, therefore, must be an imaginary circle. Nowhere do the cited portions of Smither

disclose, teach or suggest that the focal circle 24 is a structural element. Thus, for at least this reason, claim 40 is patentable over Smither.

Accordingly, reconsideration and withdrawal of the rejection of claims 40 and 126 under 35 U.S.C. §102(b) based on Smither are respectfully requested.

Claim 117 was rejected under 35 U.S.C. §102(b) based on Takahashi *et al.* (U.S. Pat. No. 5,097,352) (hereinafter "Takahashi"). The rejection is respectfully traversed.

Claim 117 recites an optical system comprising, *inter alia*, a plurality of variable optical-property elements each having a variable optical power, ..., wherein the variable optical-property elements are arranged to be decentered from one another.

It is respectfully submitted that there is nothing in the cited portions of Smither that remotely discloses, teaches or suggests each and every limitation recited in claim 117 including the features identified above.

By way of review, the cited portions of Takahashi disclose an objective lens unit including a liquid crystal device. *See* Takahashi at col. 3, lines 52-59 and FIG. 8. The liquid crystal device of Takahashi may include a liquid crystal stop portion that comprises two liquid crystal cells 7, 7 (identified by the Office Action as the "plurality of variable optical-property elements" of claim 117) positioned between three annular polarizing plates 44. *See* Takahashi at col. 9, lines 28-33 and FIGS. 21A-B.

However, unlike claim 117, the cited portions of Takahashi do not disclose, teach or suggest a plurality of variable optical-property elements that are arranged to be decentered from one another. The cited portions of Takahashi merely disclose that the liquid crystal cells 7,7 are coaxially arranged, not decentered from one another as recited in claim 117. Therefore, even assuming, *arguendo*, that liquid crystal cells 7, 7 in FIGS. 21A-B of Takahashi could be used in the optical system shown in FIG. 8 of Takahashi, the resulting optical system of Takahashi would not form a structure in which two liquid crystal cells are arranged to be decentered from another. Therefore, claim 117 is patentable over Takahashi.

Accordingly, reconsideration and withdrawal of the rejection of claim 117 under 35 U.S.C. §102(b) based on Takahashi are respectfully requested.

Claims 40, 49, 84 and 92-94 were rejected under 35 U.S.C. §103(a) based on Takahashi in view of Hochstrate (U.S. Pat. No. 4,196,973). The rejection is respectfully traversed.

Claim 40 and Takahashi are discussed above. The Examiner concedes that Takahashi does not disclose, teach or suggest a variable optical property element that is a reflection type

element, which includes a reflecting surface. However, there are additional features that are absent in Takahashi.

For example, the cited portions of Takahashi fail to disclose, teach or suggest a variable optical-property mirror having a reflecting surface that is deformable, and wherein the reflecting surface is a free-formed surface having only one plane of symmetry.

Unlike claim 40, the cited portions of Takahashi merely disclose surfaces with more than one plane of symmetry. For example, in FIG. 14 of Takahashi, both surfaces of the liquid crystal stop 34 are plane surfaces. Therefore, each surface of the liquid crystal stop 34 of Takahashi has an infinite number of planes of symmetry. As another example, in FIG. 16 of Takahashi the crystal cell 7 is bent to be symmetrical with respect to the optical axis. *See* Takahashi at col. 8, lines 15-20. Therefore, each surface of the liquid crystal stop 34 in FIG. 16 also has an infinite number of planes of symmetry. Nowhere do the cited portions of Takahashi disclose, teach or suggest a reflecting surface that is a free-formed surface having only one plane of symmetry, as in claim 40.

Furthermore, despite the Office Action's assertion, there is no teaching or suggestion in the cited portions of Takahashi that the bent surfaces of crystal cell 7 in FIG. 16 correspond to those of crystal cell 7 of FIG. 14, as alleged by the Examiner. *See* Office Action at pages 4 and 5. The liquid crystal stop shown in FIG. 14 of Takahashi is directed to an embodiment that is different from the embodiment of the liquid crystal stop shown in FIG. 16. Takahashi fails to disclose, teach or suggest that the liquid crystal is deformable between the state shown in FIG. 14 and the state shown in FIG. 16.

The cited portions of Hochstrate fail to remedy the deficiencies of Takahashi. The cited portions of Hochstrate merely disclose a liquid crystal display device having two planar surfaces. *See* Hochstrate at FIG. 1. Therefore, there is also an infinite number of planes of symmetry in the liquid crystal display device of Hochstrate. As such, any proper combination of Takahashi and Hochstrate cannot result, in any way, in the invention of claim 40.

Claims 92-94 are patentable over the cited portions of Takahashi, Hochstrate and any proper combination thereof at least by virtue of their dependency from claim 40 and for the additional features recited therein.

Claim 49 recites an optical system comprising, *inter alia*, a variable optical-property mirror; ... wherein a shape of a reflecting surface of the variable optical-property mirror is

deformable. It is respectfully submitted that the combination of Takahashi and Hochstrate fails to present a *prima facie* case of obviousness.

The cited portions of Takahashi fail to disclose, teach or suggest that a shape of a reflecting surface of the variable optical-property mirror is deformable. The Examiner asserts that the surface of the liquid crystal stop 34 is deformable. This is incorrect. As noted above, the cited portions of Takahashi merely disclose that the stop 34 is bent to be symmetrical with respect to the optical axis. *See* Takahashi at col. 8, lines 15-20. However, nowhere do the cited portions of Takahashi disclose, teach or suggest that the liquid crystal stop 34 is deformable between the planar state shown in FIG. 14 and the curved state shown in FIG. 16. As indicated previously, the liquid crystal stop shown in FIG. 14 is directed to an embodiment that is different from the embodiment of the liquid crystal stop shown in FIG. 16. In support of this, Takahashi states that “[t]he polarizing plates 12, 13 may also be plane surfaces,” (*see* Takahashi at col. 8, lines 34-35) which clearly indicates that both surfaces of the liquid crystal stop 34 may be constructed either as a plane surface or a spherical surface.

Furthermore, the cited portions of Takahashi fail to disclose, teach or suggest an optical element that has a rotationally asymmetric surface having a shape that defines only one plane of symmetry or no plane of symmetry. The Examiner equates element 15 of Takahashi with the optical element of claim 49. Then, the examiner asserts that the lens 15 of Takahashi has a rotationally asymmetric surface having a shape that defines only one plane of symmetry or no plane of symmetry. This is incorrect. The lens 15 of Takahashi includes a plane surface and a rotationally symmetric surface. The plane surface of the lens 15 defines an infinite number of planes of symmetry, and the other surface of the lens 15 is a spherical surface, which is rotationally symmetric.

The cited portions of Hochstrate fail to remedy the deficiencies of Takahashi. The cited portions of Hochstrate merely disclose a liquid crystal display device having two planar surfaces. *See* Hochstrate at FIG. 1. Nowhere do the cited portions of Hochstrate disclose, teach or suggest that the planar surfaces of the liquid crystal display device are deformable. As such, any proper combination of Takahashi and Hochstrate cannot result, in any way, in the invention of claim 49.

Claim 84 recites an optical system comprising, *inter alia*, a free-formed-surface optical element having a rotationally asymmetric reflecting surface and a free-formed transmission surface having only one plane of symmetry, ... wherein a positional relation

between an image surface, the free-formed-surface optical element, and the variable optical-property element remains unchanged during focusing.

The cited portions of Takahashi fail to disclose, teach or suggest, for example, the above identified features of claim 84.

Unlike claim 84, the cited portions of Takahashi merely disclose in FIG. 8 a configuration in which the prism 27 is arranged behind the liquid crystal lens 22. Each transmission surface of the prism 27 is a plane surface and thus defines an infinite number of planes of symmetry.

The cited portions of Hochstrate fail to remedy the deficiencies of Takahashi. The cited portions of Hochstrate merely disclose a liquid crystal display device having two planar surfaces. *See* Hochstrate at FIG. 1. Nowhere do the cited portions of Hochstrate disclose, teach or suggest a free-formed-surface optical element having a rotationally asymmetric reflecting surface and a free-formed transmission surface having only one plane of symmetry wherein a positional relation between an image surface; the free-formed-surface optical element, and the variable optical-property element remains unchanged during focusing, as recited in claim 84. As such, any proper combination of Takahashi and Hochstrate cannot result, in any way, in the invention of claim 84.

Applicant respectfully submits that optical systems using free-formed-surface optical elements often require a complicated focus mechanism. However, the use of a variable optical-property element as claimed achieves focusing without moving the image surface or the free-formed surface optical element.

Accordingly, reconsideration and withdrawal of the rejection of claims 40, 49, 84 and 92-94 under 35 U.S.C. §103(a) based on Takahashi in view of Hochstrate are respectfully requested.

Claims 41-42, 84, 86, 88 and 98 were rejected under 35 U.S.C. §103(a) based on Takahashi in view of Kimura et al. (U.S. Pat. No. 6,166,866) (hereinafter "Kimura"). The rejection is respectfully traversed.

Claim 41 recites an optical system comprising, *inter alia*, a variable optical-property element ... wherein the variable optical-property element is arranged between the plurality of rotationally asymmetric curved surfaces.

The Examiner concedes that Takahashi does not disclose, teach or suggest a plurality of rotationally asymmetric curved surfaces. However, there are additional features that are absent in Takahashi.

For example, the cited portions of Takahashi do not disclose, teach or suggest that the variable optical-property element is arranged between the plurality of rotationally asymmetric curved surfaces, as recited in claim 41.

Unlike claim 41, the cited portions of Takahashi merely disclose, in FIG. 8, a configuration in which the prism 27 is arranged behind the liquid crystal lens 22.

The cited portions of Kimura fail to remedy the deficiencies of Takahashi. The cited portions of Kimura disclose a reflecting-type optical system that includes an optical element composed of a transparent body having an entrance surface, an exit surface and at least three curved reflecting surfaces of internal reflection. *See* Kimura at col. 13, lines 10-26 and FIG. 2. The prism of Kimura has rotationally asymmetric curved surfaces. However, the cited portions of Kimura are silent as to a variable optical-property element arranged between the plurality of rotationally asymmetric curved surfaces, as recited in claim 41.

Furthermore, assuming, *arguendo*, that it would have been obvious to substitute the prism of Kimura for the prism 27 of Takahashi, such a combination would merely result in an optical device in which a prism having rotationally asymmetric curved surfaces is arranged behind a liquid crystal lens. However, this is not the invention of claim 41. According to claim 41, the variable optical-property element is arranged between the plurality of rotationally asymmetric curved surfaces. Any proper combination of Takahashi and Kimura does not disclose, teach or suggest these features. Thus, the combination of Takahashi and Kimura fails to present a *prima facie* case of obviousness.

Claims 42, 48, 88 and 98 are patentable over the cited portions of Takahashi, Kimura and any proper combination thereof at least by virtue of their dependency from claim 41 and for the additional features recited therein.

Claim 84 and Takahashi are discussed above. As discussed previously, the cited portions of Takahashi fail to disclose, teach or suggest, for example, an optical system comprising, *inter alia*, a free-formed-surface optical element having a rotationally asymmetric reflecting surface and a free-formed transmission surface having only one plane of symmetry, ... wherein a positional relation between an image surface, the free-formed-surface optical element, and the variable optical-property element remains unchanged during focusing.

The cited portions of Kimura fail to remedy the deficiencies of Takahashi. The cited portions of Kimura merely disclose a prism having rotationally asymmetric curved surfaces. However, each of the transmission surfaces (entrance surface and exit surface) of Kimura is a

spherical surface, which is rotationally symmetric, or a rotationally symmetric aspherical surface. Therefore, these transmission surfaces define an infinite number of planes of symmetry. As such, any proper combination of Takahashi and Kimura cannot result, in any way, in the invention of claim 84.

Claim 86 is patentable over the cited portions of Takahashi, Kimura and any proper combination thereof at least by virtue of its dependency from claim 84 and for the additional features recited therein.

Accordingly, reconsideration and withdrawal of the rejection of claims 41-42, 84, 86, 88 and 98 under 35 U.S.C. §103(a) based on Takahashi in view of Kimura are respectfully requested.

Claims 40, 86 and 95-97 were rejected under 35 U.S.C. §103(a) based on Takahashi, Kimura and Hochstrate. The rejection is respectfully traversed.

As a preliminary matter, Applicant submits that claim 40 has not been rejected over the combination of Takahashi and Kimura (claim 40 is an independent claim and thus is not dependent from any one of claims 41, 42, 84, 86, 88 and 98, which are rejected over the combination of Takahashi and Kimura). As such, the Examiner's conclusion that "Takahashi et al and Kimura et al discloses everything as disclosed above" has no basis. Therefore, the Office Action has failed to establish that claim 40 is obvious over the combination of Takahashi, Kimura and Hochstrate. Claims 95-97, which depend from claim 40 directly or indirectly, are not obvious from the combination of these references, either.

Furthermore, claim 40 is patentable over the combination of Takahashi and Hochstrate for at least the same reasons provided above. The cited portions of Kimura fail to remedy the deficiencies of Kimura. The cited portions of Kimura do not disclose, teach or suggest, for example, an optical system comprising, *inter alia*, a variable optical-property mirror; ... wherein a shape of a reflecting surface of the variable optical-property mirror is deformable. As such, any proper combination of Takahashi, Kimura and Hochstrate cannot result, in any way, in the invention of claim 40.

Claims 95-97 are patentable over Takahashi, Kimura and Hochstrate and any proper combination thereof at least by virtue of their dependency from claim 40 and for the additional features recited therein.

As discussed above, the cited portions of Takahashi, Kimura and Hochstrate do not disclose, teach or suggest, for example, an optical system comprising, *inter alia*, a free-formed-surface optical element having a rotationally asymmetric reflecting surface and a

free-formed transmission surface having only one plane of symmetry, ... wherein a positional relation between an image surface, the free-formed-surface optical element, and the variable optical-property element remains unchanged during focusing. As such, any proper combination of Takahashi, Kimura and Hochstrate cannot result, in any way, in the invention of claim 84.

Claim 86 is patentable over Takahashi, Kimura and Hochstrate and any proper combination thereof at least by virtue of their dependency from claim 84 and for the additional features recited therein.

Accordingly, reconsideration and withdrawal of the rejection of claims 40, 86, and 95-97 under 35 U.S.C. §103(a) based on Takahashi, Kimura and Hochstrate are respectfully requested.

Applicant has addressed the Examiner's rejections and respectfully submits that the application is in condition for allowance. A notice to that effect is earnestly solicited.

If any point remains in issue which the Examiner feels may be best resolved through a personal or telephone interview, please contact the undersigned at the telephone number listed below.

Please charge any fees associated with the submission of this paper to Deposit Account Number 033975. The Commissioner for Patents is also authorized to credit any over payments to the above-referenced Deposit Account.

Respectfully submitted,

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